c. $f_1(x) = x^2 - 8x + 17 \,/\, (x \geq 2 \text{ and } x \leq 5)$

Divide by a Boolean variable or enter the domain directly, depending on your grapher, to restrict the domain.

$f_2(x) = x^2 + 8x + 17 \,/\, (x \geq -5 \text{ and } x \leq -2)$

$f_3(x) = -x^2 + 8x - 17 \,/\, (x \geq 2 \text{ and } x \leq 5)$

The graphs are shown in Figure 1-6a.

You can check the algebraic solutions by plotting $f_4(x) = f_1(-x)$ and $f_5(x) = -f_1(x)$ using thick style. The graphs should overlay $f_2(x)$ and $f_3(x)$.

PROPERTY: Reflections Across the Coordinate Axes

$g(x) = -f(x)$ is a vertical reflection of function f across the x-axis.

$g(x) = f(-x)$ is a horizontal reflection of function f across the y-axis.

Absolute Value Transformations

Suppose you shoot a basketball. While in the air, it is above the basket level sometimes and below it at other times. Figure 1-6b shows $y = f(x)$, the **displacement** from the level of the basket as a function of time. If the ball is above the basket, its displacement is positive; if the ball is below the basket, its displacement is negative.

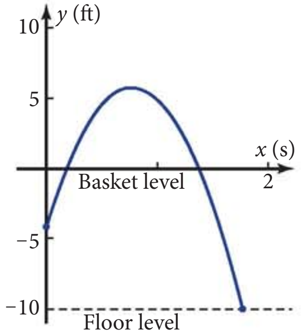

Figure 1-6b

Distance, however, is the magnitude (or size) of the displacement, which is never negative.

Distance equals the *absolute value* of the displacement. The solid graph in Figure 1-6c is the graph of $y = g(x) = |f(x)|$. Taking the absolute value of $f(x)$ retains the non-negative values of y and reflects the negative values vertically across the x-axis.

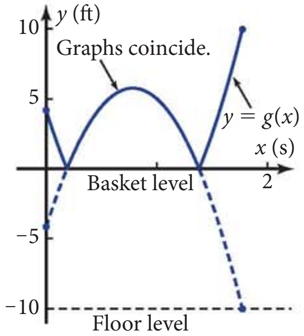

Figure 1-6c

Figure 1-6d shows what happens for $g(x) = f(|x|)$, for which you take the absolute value of the argument (this is a different function f than in the last example). For positive values of x, $|x| = x$, so $g(x) = f(x)$ and the graphs coincide. For negative values of x, $|x| = -x$, so $g(x) = f(-x)$, across the y-axis of the part of function f where $x > 0$. Notice that the graph of f for the negative values of x is not a part of the graph of $f(|x|)$.

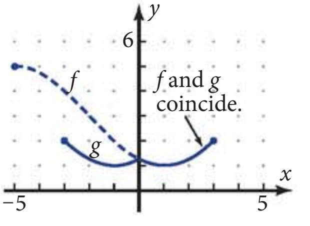

Figure 1-6d

The equation for $g(x)$ can be written this way:

$$g(x) = \begin{cases} f(x) & \text{if } x \geq 0 \\ f(-x) & \text{if } x < 0 \end{cases}$$